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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

May 17, 2000

Ms. Magalie Roman Salas
Secretary
Federal Communications Commission
445 Twelfth Street, S.W., TW-A325
Washington, D.C. 20554

Dear Ms. Salas:

Enclosed are an original and four copies of comments by Louis A. Williams, Jr. on the Notice of Proposed Rulemaking in MM Docket 00-39 Review of the Commission's Rules and Policies Affecting the Conversion to Digital Television.

Sincerely,

Patricia E. Williams

Patricia E. Williams
Office Manager

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARYBefore the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of)

Review of the Commission's)
Rules and Policies)
Affecting the Conversion)
to Digital Television)

MM Docket No. 00-39

COMMENTS OF LOUIS A. WILLIAMS, JR.
ON THE NOTICE OF PROPOSED RULEMAKING

Louis A. Williams, Jr. respectfully submits the following comments in the above-captioned proceeding. Mr. Williams is a Professional Engineer providing consulting and measurement services for over thirty years, primarily to communication, radio, and television stations. Should additional information be desired as to Mr. Williams' qualifications, he will supply such information.

Background

The subject Notice of Proposed Rulemaking is the first of an anticipated series of periodic reviews that the Commission has planned on the progress of the conversion of the country's television stations from NTSC to DTV. While the Notice is focused on whether to require replication, city grade service, and a deadline for selection of post-transition DTV channels, as well as how to resolve mutually exclusive applications, one of the most significant technical details is how to determine replication.

In [22] the Commission notes

If we decide to adopt a replication requirement, we must decide how to determine whether a DTV station is replicating its NTSC facilities. One possible approach would be to require essentially the same service as is provided by the NTSC facilities. In order to implement this approach, we would need to decide whether to depict NTSC and DTV service using coverage contours or using the Longley-Rice propagation model in accordance with OET Bulletin 69 (July 2, 1997). We would also need to decide whether the replication requirement should be based on the population or the area served. We note that our rules for determining interference between DTV stations are based on population. Finally, we would need to address the question of what percentage of the NTSC Grade B service must be replicated.

This paragraph would appear to open for discussion the definition of the current Grade B contour, the use of the standard F(50,50) curves to determine the Grade B contour, the use of Longley-Rice to determine DTV coverage, the use of population centroids or geometric centers as the locus of points in the DTV coverage cell matrix, the definition of replication, and the tolerance to be placed on replication.

Under this interpretation, facilities already planned, under construction, or completed with the premise that the investment will be amortized over several years may now be subject to replacement in two or three years. Stations with minimal DTV facilities would not be significantly affected. The stations that

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are leading the way toward full penetration of DTV service could be directly impacted.

Recommendations

These recommendations are based on providing a technically sound approach without disrupting the conversion to DTV:

1. The current coverage prediction method for NTSC, namely the standard F(50,50) curves and the current definitions of city grade, Grade A and Grade B contours, should be left unchanged. The use of Longley-Rice to determine DTV coverage within a contour determined using the standard F(50,50) curves and the relevant DTV planning factors should be continued.

2. Geographic centers instead of population centroids should be used as the locus of terminal points in the DTV Longley-Rice coverage cell matrix. The cell size in the DTV coverage matrix should be reduced to as small a size as necessary to accurately represent the terrain and population distribution. The height above average terrain should be determined directly for each radial used. The spacing increment or step size should be reduced in proportion to the cell size used. The population in each of these smaller cells should be used to determine DTV service population and interference populations.

3. DTV service populations and interference populations determined by the present population centroid method using two km cells should be grandfathered for any existing licensees, permittees, or applicants, until the next change of power, antenna height, antenna pattern, or antenna location.

4. DTV replication should be defined as coverage of the NTSC Grade B contour or coverage of the population within the NTSC Grade B contour. The tolerance for achieving replication should be plus or minus five percent in either population or coverage area.

5. The Commission's proposal to use the same increments to define principal community signal requirements for DTV as for NTSC is reasonable, although as experience is gained with DTV the Commission may need to adjust these increments for DTV. Until such time these increments offer some assurance of improved coverage inside the community of license.

Recommendation 1: Prediction Models

The standard F(50,50) curves are based on the area prediction model given in Damelin, et. al.¹ Damelin's model is primarily an empirical model using data from a number of measurement sources. As an empirical model, Damelin includes the effects of what is now called terrain clutter.² Mobile measurements were made using the standard C.C.I.R. 30 foot receiving antenna height and a 100 foot measurement run. Long-term fixed-point data was corrected for "preferred location bias," using mobile measurements as a reference.

Because of the use of the standard C.C.I.R. measurement procedure and the experience and technical competency of the individuals collecting the data, the

¹Jack Damelin, William A. Daniel, Harry Fine, and George V. Waldo, "Development of VHF and UHF Propagation Curves for TV and FM Broadcasting," FCC Report No. R-6602, September 7, 1966.

²For a discussion of terrain clutter, see the record for "Establishment of an Improved Model for Predicting the Broadcast Television Field Strength Received at Individual Locations," ET Docket No. 00-11.

Damelin model is biased toward what can be called a high level of confidence (a low level of situational variability). That is, the results are fairly repeatable and represent the nominal values that would be measured using the same technique under the same set of conditions.

Longley-Rice (also known as ITS) has both theoretical and empirical bases³. The most notable differences to the user between Damelin and Longley-Rice are the use of the entire terrain profile between transmitter and receiver, the choice of various point-to-point or area computational modes, and significantly more input parameters.

Longley-Rice allows the user to select the confidence level of the prediction. The Commission has chosen, for better or worse, to set the confidence level for all Longley-Rice calculations to 50 percent.⁴ As has been noted, "the result of using the LR model with a 50% confidence level is not comparable to that of using the FCC's (50,50) curves, and ... confidence levels of at least 90% must be used in the UHF band."⁵ Predictions made using Longley-Rice with 50 percent confidence are usually more optimistic than predictions made using the standard F(50,50) curves.

Since the differences between the standard F(50,50) curves and Longley-Rice can be significant, and since existing NTSC allocations are based on the standard F(50,50) curves, while the DTV allocations are based on both the standard curves and on the Longley-Rice model, fairness dictates that these models continue to be used as they are at present.

Recommendation 2: Changes to the LR Parameters

At the present time for DTV the area within the relevant contour is divided into rectangular cells that are 2 km square. For cells with population, the population centroid in the cell is identified. For cells without population, the geometric center is identified. Longley-Rice is then used to calculate the signal level at the selected point in each cell using a 1 km step size between the transmitting antenna and the selected point.

This method makes the population database an integral part of the signal level algorithm. When the population database changes, as it will when the Census for 2000 is released, the population centroid, the path profile, and the coverage area results will also change. The population database can be separated from the signal level calculation by using the geometric center of each cell regardless of whether the cell contains population or not. The population within the cell is then determined in a separate computation, and only for the cells that have sufficient signal level.

Separating the signal level computation from the population computation results in constant coverage area for a given facility, even as the population count changes with time. In order to maintain and improve the Commission's objective of serving population and not just area, the cell sizes should be reduced to as small a size as necessary to accurately represent the terrain and

³See P. L. Rice, A. G. Longley, K. A. Norton, and A. P. Barsis, "Transmission Loss Predictions for Tropospheric Communication Circuits," NBS Technical Note 101, issued May 1965, revised May 1966 and January 1967.

⁴For example, see OET Bulletin 69, July 2, 1997.

⁵O. Bendov, "On the Validity of the Longley-Rice (50,90/10) Propagation Model for HDTV Coverage and Interference Analysis," Dielectric Products, available at <http://www.dielectric.com/broadcast/longley-rice.html>.

population distribution. The population in each of these smaller cells can then be used to determine DTV service population and interference populations.

Rough terrain and/or heavily populated areas will benefit from the smallest cell size that can be supported by available computers and data bases.⁶ For example, a cell size of 0.25 km is about three or four square blocks in a typical city.

In the interest of computational accuracy, the height above average terrain should be determined directly for each radial used. The spacing increment or step size should be reduced in proportion to the cell size used.⁷ For example, a step size of 0.1 km is compatible with both the 3-second and the newer 30-meter point elevation databases. Large step sizes miss significant terrain obstructions compared to cell sizes.

Recommendation 3: Grandfathering

Present NTSC and DTV designs are based on the existing rules for determining coverage and interference. While the proposed changes will improve the ultimate accuracy of the modeling process, in order to eliminate the possibility of economic hardship on licensees, permittees, and applicants, present designs should be grandfathered until such time as redesign becomes necessary.

Recommendation 4: Replication

The Commission's original goal in the creation of the DTV Table of Allotments was to have DTV service match the Grade B service of the NTSC station with which it was paired.⁸ Many stations have designed their DTV facilities on this basis and to alter this goal at this late stage would be a significant setback in implementation of DTV service.

Broadening the definition of replication to include matching the service to the population within the NTSC Grade B contour is suggested as an alternative to matching the NTSC Grade B contour. In many cases this will be equivalent. However, in some cases with significant variations in population, for example, due to mountains or bodies of water, the additional flexibility may be useful.

A five percent tolerance on the accuracy of replication is recommended as a reasonable compromise between facility design and continuation of service. Licensees have an economic interest in serving as many people as possible and the tolerance will primarily force those stations with small initial DTV facilities to improve their coverage.

Recommendation 5: Principal Community Service Requirements

The understanding of DTV coverage within a station's principal community is still in its infancy. As the Commission notes in [28], the effects of insufficient signal differ between NTSC and DTV. With NTSC the classification of city grade, Grade A, and Grade B coverage is based on the subjective tolerance

⁶Typical cell sizes of 0.25 to 1.0 km are anticipated.

⁷Typical step sizes of 0.1 to 0.5 km are anticipated.

⁸*Sixth Report and Order* in MM Docket No. 87-268, 12 FCC Rcd 14588 (1997), 29-30.

of the viewer to noise in the picture.⁹ For DTV there are no changes in picture quality with signal strength. When the DTV signal is below threshold, the picture will freeze or disappear. The quality of DTV service will ultimately be based on the viewer's tolerance to these outages, and little data has been collected on this tolerance.

In view of this lack of data, the Commission's approach is as good as any. The noise sources that degrade NTSC as the receiving antenna decreases from a good outside antenna at the edge of the Grade B contour to rabbit ears inside the city grade contour might also be expected to degrade DTV thresholds in like manner. Imposing a requirement for city grade service will also provide further assurance that the replication intent of the Commission as noted in [20] will be achieved.

If necessary, the Commission can stay or waiver the imposition of a Principal Community contour requirement until such time as additional data is available, rather than until a specific date. This still serves notice that a station would be ill advised to deviate significantly from the Commission's philosophical intent.

Respectfully Submitted,



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May 17, 2000

⁹Robert A. O'Connor, "Understanding Television's Grade A and Grade B Service Contours," *IEEE Transactions on Broadcasting*, Vol. BC-14, No. 4, December 1968, pp. 137-143.